STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

READINESS (Kindergarten)

Students know and are able to do the following:

- **4M-R1. Identify, compare, classify, draw and make models of shapes**

- **4M-R2. Recognize geometry in their surroundings**

FOUNDATIONS (Grades 1-3)

Students know and are able to do all of the above and the following:

- **4M-F1. Relate geometric concepts to number and measurement ideas (e.g., dividing a rectangle into parts to represent multiplication)**

   Note: - two-dimensional shapes: square, rectangle, triangle, circle
   *   - three-dimensional figures: sphere, cube, rectangular prism (box), cone, pyramid*
   *   - attributes: size; shape; the number of sides, corners and faces*

   PO 1.   Identify two-dimensional shapes by name and attribute
   PO 2.   Draw two-dimensional shapes
   PO 3.   Identify three-dimensional figures by name and/or attribute
   PO 4.   Compare attributes of two-dimensional shapes
   PO 5.   Compare attributes of three-dimensional figures
   PO 6.   Use a rectangular array to represent a multiplication fact (e.g., put 12 tiles in a rectangular array; make a 3 x 4, 6 x 2, and 12 x 1 array)

- **4M-F2. Predict how shapes can be changed by combining or dividing them**

   PO 1.   Build geometric shapes with other common shapes (e.g., tangrams, pattern blocks, geoboards)

ESSENTIALS (Grades 4-8)

Students know and are able to do all of the above and the following:

- **4M-E1. Visualize and draw two- and three-dimensional geometric figures with special attention to analyzing and reasoning informally about their properties (e.g., parallelism, perpendicularity and congruence)**

(Grades 4-5)
PO 1.   Classify two-dimensional shapes and three-dimensional figures by their properties
      A. by sight
PO 2.   Identify the properties of geometric figures using appropriate terminology and vocabulary (e.g., parallelism, perpendicularity and congruency)
      A. two-dimensional shapes (three- and four-sided polygons)
PO 3. Draw or build two-dimensional shapes by applying significant properties of each (e.g., draw a rectangle with two sets of parallel sides and four right angles)

(Grades 6-8)
PO 1.   Classify two-dimensional shapes and three-dimensional figures by their properties
      B. by properties
PO 2.   Identify the properties of geometric figures using appropriate terminology and vocabulary (e.g., parallelism, perpendicularity and congruency)
      B. three-dimensional figures (prisms)
PO 3.   Draw or build three-dimensional figures by applying significant properties of each (e.g., draw a rectangle with two sets of parallel sides and four right angles)

- **4M-E2. Apply geometric properties and relationships such as congruence, similarity, angle measure, parallelism and perpendicularity to real-world situations**

(Grades 4-5)
PO 1.   Design or draw a model (e.g., designing a playhouse, garden) that demonstrates basic geometric relationships, such as
      A. parallelism, perpendicularity, similarity
PO 2.   Classify triangles by their angles and sides (e.g., equilateral, acute, isosceles . . .)
PO 5.   Identify lines that are parallel and perpendicular
PO 6.   Distinguish shapes that are congruent

(Grades 6-8)
PO 1.   Design or draw a model (e.g., designing a playhouse, garden) that demonstrates basic geometric relationships, such as
      B. all of the above and proportionality and congruency
PO 3.   Label corresponding, supplementary and complementary angles
PO 4.   Measure and label specified angles (e.g., alternate interior, obtuse, acute, right, corresponding . . .)

- **4M-E3. Perform elementary transformations (e.g., tessellations, flips, slides, rotations)**

(Grades 4-5)
PO 1.   Demonstrate slide, flip or turn using concrete geometric figures
PO 2.   Illustrate, using concrete or pictorial models
      A. slide, flip or turn (e.g., quilts)
PO 3.   Draw or build a shape that
      A. has symmetry

(Grades 6-8)
PO 2. Illustrate, using concrete or pictorial models
       B. reflections, rotations and translations (e.g., tessellations)
PO 3. Draw or build a shape that
       B. has two or more lines of symmetry

- **4M-E4. Represent and solve problems relating to size, shape, area and volume using geometric models**

(Grades 4-5)
PO 1. Solve problems using **given** formulas for
       A. simple area and perimeter
PO 2. Identify a variety of shapes having the same perimeter and area

(Grades 6-8)
PO 1. Solve problems using **given** formulas for
       B. area, perimeter/circumference of various circles/polygons
       C. volume of prisms
PO 3. Draw or build a variety of shapes having the same perimeter and area

PROFICIENCY (Grades 9-12)

Students know and are able to do all of the above and the following:

- **4M-P1. Interpret and draw three-dimensional objects**

Core – will be tested on AIMS
PO 1. Sketch prisms, pyramids, cones, cylinders and spheres
PO 2. Classify prisms, pyramids, cones, cylinders and spheres by base shape and lateral surface shape
PO 3. Recognize the three-dimensional figure represented by a two-dimensional drawing (e.g., "What figures are represented by given nets, sketches, photographs?")

- **4M-P2. Represent problem situations with geometric models and apply properties of figures**

Core – will be tested on AIMS
PO 1. Calculate surface areas and volumes of three-dimensional geometric figures, given the required formulas
PO 2. Solve applied problems using angle and side length relationships
PO 3. Solve applied problems using the Pythagorean theorem (e.g., determine whether a wall is square)
PO 4. Solve applied problems using congruence and similarity relationships of triangles (e.g., estimate the height of a building, using shadows)

PO 6. Determine the distance and midpoint between points within a coordinate system representative of a practical application

PO 7. Find the area of a geometric figure composed of a combination of two or more geometric figures, given an appropriate real-world situation and the formulas

PO 8. Solve problems involving complementary, supplementary and congruent angles

Core – to be taught in grades 9-10, but will not be tested on AIMS

PO 5. Make a model of a three-dimensional figure from a two-dimensional drawing and make a two-dimensional representation of a three-dimensional object (models and representations include scale drawings, perspective drawings, blueprints or computer simulations)

- **4M-P3. Deduce properties of figures using transformations in coordinate systems, identifying congruency and similarity**

Core – will be tested on AIMS

PO 1. Determine whether a planar figure is symmetric with respect to a line

PO 3. Determine the effects of a transformation on linear and area measurements of the original planar figure

PO 4. Sketch the planar figure that is the result of a given transformation

Core – to be taught in grades 9-10, but will not be tested on AIMS

PO 2. Give the new coordinates of a transformed geometric planar figure

- **4M-P4. Deduce properties of, and relationships between, figures from given assumptions**

Core – will be tested on AIMS

PO 1. Find similarities and differences among geometric shapes and designs using a given attribute (e.g., height, area, perimeter, diagonals and angle measurements)

PO 2. Identify arcs, chords, tangents and secants of a circle

PO 3. State valid conclusions using given geometric definitions, postulates and theorems

PO 4. Represent *pi* as the ratio of circumference to diameter (Moved from 1M-P2, PO5)

- **4M-P5. Translate between synthetic and coordinate representations (e.g., a straight line is represented by the algebraic equation $Ax + By = C$)**

Core – will be tested on AIMS

PO 1. Determine the relative placement of two lines on a coordinate plane by examining the algebraic equations representing them

Core – to be taught in grades 9-10, but will not be tested on AIMS

PO 2. Verify characteristics of a given geometric figure using coordinate formulas such as distance, mid-point, and slope to confirm parallelism, perpendicularity and congruency

- **4M-P6. Recognize and analyze Euclidean transformations (e.g., reflections, rotations, dilations and translations)**

Core – will be tested on AIMS
PO 1.   Classify transformations based on whether they produce congruent or similar non-congruent figures
PO 2.   Determine whether a given pair of figures on a coordinate plane represents a translation, reflection, rotation and/or dilation

Core – to be taught in grades 9-10, but will not be tested on AIMS
PO 3.   Apply transformational principles to practical situations (e.g., enlarge a photograph)

DISTINCTION (Honors)

Students know and are able to do all of the above and the following:

- **4M-D1. Deduce properties of figures using vectors**

- **4M-D2. Apply transformations, coordinates and vectors in problem solving**